Water Quality Assessment
San Juan River
Pagosa Springs Sanitation District's Wastewater Treatment Facility

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I. Water Quality Assessment Summary

Table A-1 includes summary information related to this WQA. This summary table includes key regulatory starting points used in development of the WQA such as: receiving stream information; threatened and endangered species; 303(d) and Monitoring and Evaluation listings; low flow and facility flow summaries; and a list of parameters evaluated.

Table A-1
WQA Summary

Facility Information			
Facility Name	**Permit Number**	**Design Flow (max 30-day ave, MGD)**	**Design Flow (max 30-day ave, CFS)**
Pagosa Springs Sanitation District's WWTF	CO0022845	0.494	0.76

Receiving Stream Information			
Receiving Stream Name	**Segment ID**	**Designation**	**Classification(s)**
San Juan River	COSJSJ06a	Undesignated	Aquatic Life Cold 1 Recreation Class E Agriculture Water Supply

Low Flows (cfs)			
1E3 (1-day)	**7E3 (7-day)**	**30E3 (30-day)**	**Ratio of 30E3 to the Design Flow (cfs)**
8.5	11	11	14:1

Regulatory Information					
T&E Species	**303(d) (Reg 93)**	**Monitor and Eval (Reg 93)**	**Existing TMDL**	**Temporary Modification(s)**	**Control Regulation**
No	None	None	No	None	None

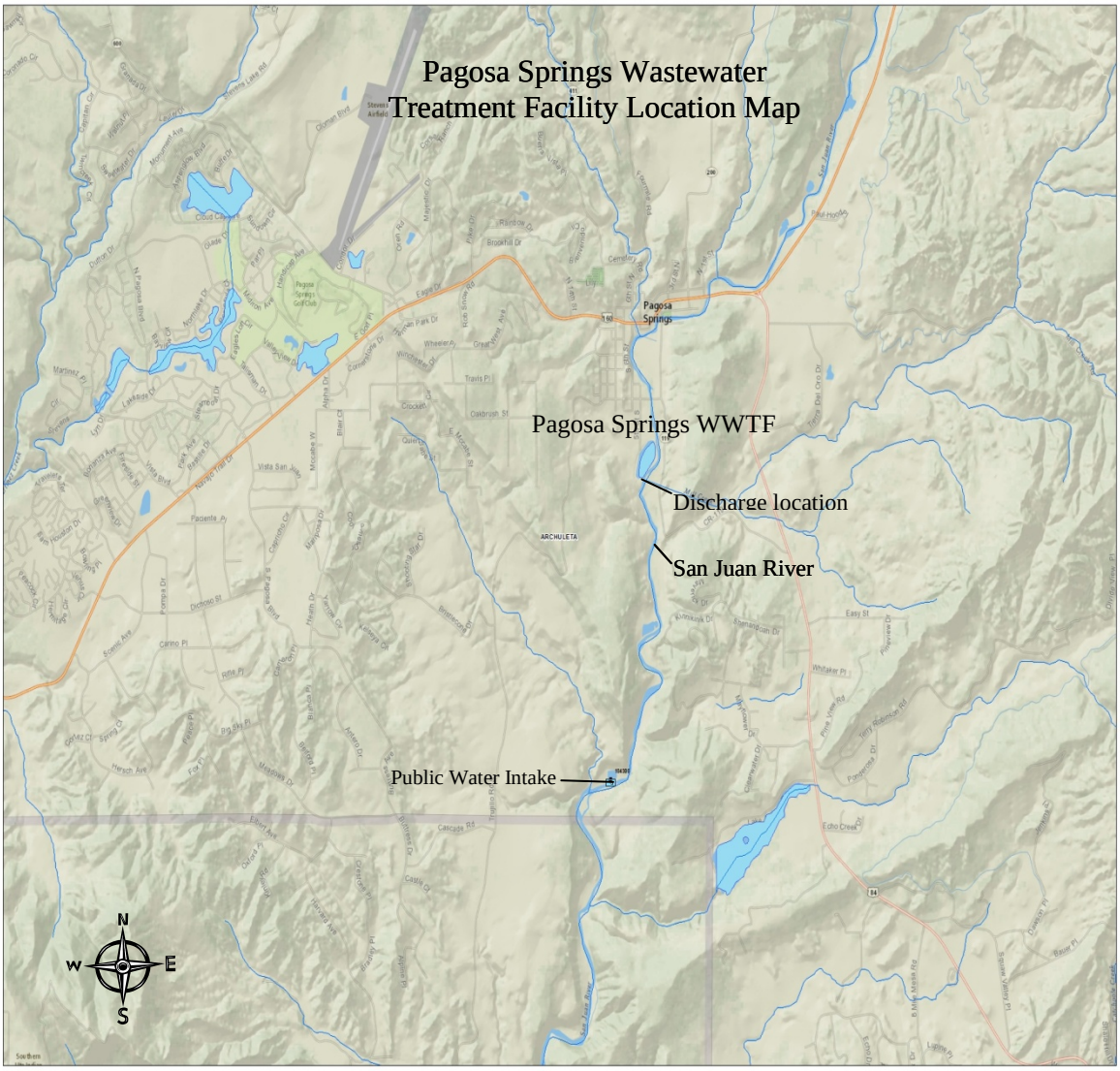
Pollutants Evaluated
Ammonia, Fecal Coliform, *E. coli*, Total Residual Chlorine, Salinity, Temperature

II. Introduction

The water quality assessment (WQA) of the San Juan River near the Pagosa Springs Sanitation District's Wastewater Treatment Facility (WWTF), located in Archuleta County, is intended to determine the assimilative capacities available for pollutants found to be of concern. This WQA describes how the water quality based effluent limits (WQBELs) are developed. These parameters may or may not appear in the permit with limitations or monitoring requirements, subject to other determinations such as reasonable potential analysis, evaluation of federal effluent limitation guidelines, implementation of state-based technology based limits, mixing zone analyses, 303(d)

listings, threatened and endangered species listing, or other requirements as discussed in the permit rationale. Figure A-1 contains a map of the study area evaluated as part of this WQA.

FIGURE A-1



The Pagosa Springs Sanitiation District's WWTF discharges to the San Juan River, which is stream segment COSJSJ06a. This means the San Juan River Basin, San Juan Sub-basin, Stream Segment 06a. This segment is composed of the "Mainstem of the San Juan River from a point immediately below the confluence with Fourmile Creek to the Southern Ute Indian Reservation norhtern boundary. Mainstem of Mill Creek from the source to the confluence with the San Juan River." Stream segment COSJSJ06a is classified for Aquatic Life Cold 1, Recreation Class E, Water Supply and Agriculture.

This area of Colorado hosts a variety of recreational activities and thus attracts many tourists.

Information used in this assessment includes data gathered from the Pagosa Springs Sanitation District's WWTF, the Division, the U.S. Environmental Protection Agency (EPA), and the U.S. Geological Survey (USGS). The data used in the assessment consist of the best information available at the time of preparation of this WQA analysis.

III. Water Quality Standards

Narrative Standards

Narrative Statewide Basic Standards have been developed in Section 31.11(1) of the regulations, and apply to any pollutant of concern, even where there is no numeric standard for that pollutant. Waters of the state shall be free from substances attributable to human-caused point source or nonpoint source discharges in amounts, concentrations or combinations which:

for all surface waters except wetlands;

(i) can settle to form bottom deposits detrimental to the beneficial uses. Depositions are stream bottom buildup of materials which include but are not limited to anaerobic sludge, mine slurry or tailings, silt, or mud; or (ii) form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or (iii) produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species or to the water; or (iv) are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or (v) produce a predominance of undesirable aquatic life; or (vi) cause a film on the surface or produce a deposit on shorelines; and

for surface waters in wetlands;

(i) produce color, odor, changes in pH, or other conditions in such a degree as to create a nuisance or harm water quality dependent functions or impart any undesirable taste to significant edible aquatic species of the wetland; or (ii) are toxic to humans, animals, plants, or aquatic life of the wetland.

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for any parameter of concern could be put in CDPS discharge permits.

Standards for Organic Parameters and Radionuclides

Radionuclides: Statewide Basic Standards have been developed in Section 31.11(2) and (3) of *The Basic Standards and Methodologies for Surface Water* to protect the waters of the state from radionuclides and organic chemicals.

In no case shall radioactive materials in surface waters be increased by any cause attributable to municipal, industrial, or agricultural practices or discharges to as to exceed the following levels, unless alternative site-specific standards have been adopted. Standards for radionuclides are shown in Table A-2.

Table A-2
Radionuclide Standards

Parameter	Picocuries per Liter

Americium 241*	0.15
Cesium 134	80
Plutonium 239, and 240*	0.15
Radium 226 and 228*	5
Strontium 90*	8
Thorium 230 and 232*	60
Tritium	20,000

*Radionuclide samples for these materials should be analyzed using unfiltered (total) samples.
These Human Health based standards are 30-day average values for both plutonium and americium.

Organics: The organic pollutant standards contained in the Basic Standards for Organic Chemicals Table are applicable to all surface waters of the state for the corresponding use classifications, unless alternative site-specific standards have been adopted. These standards have been adopted as "interim standards" and will remain in effect until alternative permanent standards are adopted by the Commission. These interim standards shall not be considered final or permanent standards subject to antibacksliding or downgrading restrictions. Although not reproduced in this WQA, the specific standards for organic chemicals can be found in Regulation 31.11(3).

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for radionuclides, organics, or any other parameter of concern could be put in CDPS discharge permits.

The aquatic life standards for organics apply to all stream segments that are classified for aquatic life. The water supply standards apply only to those segments that are classified for water supply. The water + fish standards apply to those segments that have a Class 1 aquatic life and a water supply classification. The fish ingestion standards apply to Class 1 aquatic life segments that do not have a water supply designation. The water + fish and the fish ingestion standards may also apply to Class 2 aquatic life segments, where the Water Quality Control Commission has made such determination.

Because the San Juan River is classified for Aquatic Life Cold 1 with a water supply designation, the water + fish standards apply to this discharge.

Salinity

Regulation 61.8(2)(l) contains requirements regarding salinity for any discharges to the Colorado River Watershed. For industrial dischargers and for the discharge of intercepted groundwater, this is a no-salt discharge requirement. However, the regulation states that this requirement may be waived where the salt load reaching the mainstem of the Colorado River is less than 1 ton per day, or less than 350 tons per year. The Division may permit the discharge of salt upon a satisfactory demonstration that it is not practicable to prevent the discharge of all salt. See Regulation 61.8(2)(l)(i)(A)(1) for industrial discharges and 61.8(2)(l)(iii) for discharges of intercepted groundwater for more information regarding this demonstration.

For municipal dischargers, an incremental increase of 400 mg/l above the flow weighted averaged salinity of the intake water supply is allowed. This may be waived where the salt load reaching the mainstem of the Colorado River is less than 1 ton per day, or less than 366 tons per year. The

Division may permit the discharge of salt in excess of the 400 mg/l incremental increase, upon a satisfactory demonstration that it is not practicable to attain this limit. See Regulation 61.8(2)(l)(vi)(A)(1) for more information regarding this demonstration.

In addition, the Division's policy, Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, may be applied to discharges where an agricultural water intake exists downstream of a discharge point. Limitations for electrical conductivity and sodium absorption ratio may be applied in accordance with this policy.

Temperature

Temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life. This standard shall not be interpreted or applied in a manner inconsistent with section 25-8-104, C.R.S.

Segment Specific Numeric Standards

Numeric standards are developed on a basin-specific basis and are adopted for particular stream segments by the Water Quality Control Commission. The standards in Table A-3 have been assigned to stream segment COSJSJ06a in accordance with the *Classifications and Numeric Standards for San Juan River and Dolores River Basins*.

An amendment to the *Classifications and Numeric Standards for San Juan River and Dolores River Basins* that becomes effective on March 31, 2013, will change the applicable temperature, chronic trivalent chromium, and chronic molybdunem standards for stream segment COSJSJ06a. This WQA has been developed in conformance with the water quality standards that will become effective on March 31, 2013, as any permitting action based on this WQA would take effect immediately after (or just prior) to the effective date of this regulation.

Table A-3   ***In-stream Standards for Stream Segment COSJSJ06a***
Physical and Biological
Dissolved Oxygen (DO) = 6 mg/l, minimum (7 mg/l, minimum during spawning)
pH = 6.5 - 9 su
E. coli chronic = 126 colonies/100 ml
Inorganic
Total Ammonia acute and chronic = TVS
Chlorine acute = 0.019 mg/l
Chlorine chronic = 0.011 mg/l
Free Cyanide acute = 0.005 mg/l
Sulfide chronic = 0.002 mg/l
Boron chronic = 0.75 mg/l
Nitrite acute = 0.05 mg/l
Nitrate acute = 10 mg/l
Chloride chronic = 250 mg/l
Sulfate chronic = For WS, the greater of ambient water quality as of January 1, 2000 or 250 mg/l

Metals
Total Recoverable Aluminum acute and chronic = TVS
Dissolved Arsenic acute = 340 µg/l
Total Recoverable Arsenic chronic = 0.02 µg/l
Dissolved Cadmium acute for trout and Dissolved Cadmium chronic = TVS
Total Recoverable Trivalent Chromium acute = 50 µg/l
Dissolved Hexavalent Chromium acute and chronic = TVS
Dissolved Copper acute and chronic = TVS
Dissolved Iron chronic = For WS, the greater of ambient water quality as of January 1, 2000, or 300 µg/l
Total Recoverable Iron chronic = 1000 µg/l
Dissolved Lead acute and chronic = TVS
Dissolved Manganese chronic = For WS, the greater of ambient water quality as of January 1, 2000, or 50 µg/l
Dissolved Manganese acute and chronic = TVS
Total Recoverable Molybdenum chronic = 160 µg/l
Total Mercury chronic = 0.01 µg/l
Dissolved Nickel acute and chronic = TVS
Dissolved Selenium acute and chronic = TVS
Dissolved Silver acute and Dissolved Silver chronic for trout = TVS
Dissolved Zinc acute and chronic = TVS
Nonylphenol acute = 28 µg/l
Nonylphenol chronic = 6.6 µg/l
Metals
Total Recoverable Arsenic chronic = 0.02 µg/l
Total Recoverable Beryllium chronic = 4 µg/l
Total Recoverable Molybdenum chronic = 160 µg/l
Total Mercury chronic =0.01 µg/l

Table Value Standards and Hardness Calculations

As metals with standards specified as TVS are not included as parameters of concern for this facility, the hardness value of the receiving water and the subsequent calculation of the TVS equations is inconsequential and is therefore omitted from this WQA.

Total Maximum Daily Loads and Regulation 93 – Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List

This stream segment is not listed on the Division's 303(d) list of water quality impacted streams and is not on the monitoring and evaluation list.

IV. Receiving Stream Information

Low Flow Analysis

The Colorado Regulations specify the use of low flow conditions when establishing water quality based effluent limitations, specifically the acute and chronic low flows. The acute low flow, referred to as 1E3, represents the one-day low flow recurring in a three-year interval, and is used in developing limitations based on an acute standard. The 7-day average low flow, 7E3, represents the seven-day average low flow recurring in a 3 year interval, and is used in developing limitations

based on a Maximum Weekly Average Temperature standard (MWAT). The chronic low flow, 30E3, represents the 30-day average low flow recurring in a three-year interval, and is used in developing limitations based on a chronic standard.

To determine the low flows available to the Pagosa Springs Sanitation District's WWTF, USGS gage station 09342500 (San Juan River at Pagosa Springs, CO) was used. This flow gage provides a representative measurement of upstream flow because it is located within a reasonable distance (±1 mile) upstream of the WWTF.

Daily flows from the USGS Gage Station 09342500 (San Juan River at Pagosa Springs, CO) were obtained and the annual 1E3 and 30E3 low flows were calculated using U.S. Environmental Protection Agency (EPA) DFLOW software. The output from DFLOW provides calculated acute and chronic low flows for each month.

Flow data from January 1, 2000 through October 15, 2012 were available from the gage station. The gage station and time frames were deemed the most accurate and representative of current flows and were therefore used in this analysis.

Based on the low flow analysis described previously, the upstream low flows available to the Pagosa Springs Sanitation District's WWTF were calculated and are presented in Table A-4.

Table A-4
Low Flows for the San Juan River at the Pagosa Springs Sanitation District's WWTF

Low Flow (cfs)	*Annual*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
1E3 Acute	8.5	31	32	29	52	44	17	12	8.5	8.5	29	36	28
7E3 Chronic	11	34	33	33	52	44	17	13	11	11	29	36	34
30E3 Chronic	11	34	33	33	83	114	17	13	11	11	36	36	34

During the months of April, May, October, and November the acute low flow calculated by DFLOW exceeded the chronic low flow. In accordance with Division standard procedures, the acute low flow was thus set equal to the chronic low flow for these months.

The ratio of the low flow of the San Juan River to the Pagosa Springs Sanitation District's WWTF design flow is 14:1.

Mixing Zones

The amount of the available assimilative capacity (dilution) that may be used by the permittee for the purposes of calculating the WQBELs may be limited in a permitting action based upon a mixing zone analysis or other factors. These other factors that may reduce the amount of assimilative capacity available in a permit are: presence of other dischargers in the vicinity; the presence of a water diversion downstream of the discharge (in the mixing zone); the need to provide a zone of

passage for aquatic life; the likelihood of bioaccumulation of toxins in fish or wildlife; habitat considerations such as fish spawning or nursery areas; the presence of threatened and endangered species; potential for human exposure through drinking water or recreation; the possibility that aquatic life will be attracted to the effluent plume; the potential for adverse effects on groundwater; and the toxicity or persistence of the substance discharged.

Unless a facility has performed a mixing zone study during the course of the previous permit, and a decision has been made regarding the amount of the assimilative capacity that can be used by the facility, the Division assumes that the full assimilative capacity can be allocated. Note that the review of mixing study considerations, exemptions and perhaps performing a new mixing study (due to changes in low flow, change in facility design flow, channel geomorphology or other reason) is evaluated in every permit and permit renewal.

If a mixing zone study has been performed and a decision regarding the amount of available assimilative capacity has been made, the Division may calculate the water quality based effluent limitations (WQBELs) based on this available capacity. In addition, the amount of assimilative capacity may be reduced by T&E implications.

Pagosa Springs Sanitation District's WWTF does not meet the exemption dilution ratio, nor does it have enough information to make a mixing zone determination; therefore, the Division requires the facility to test for further mixing zone exclusions within three years (until January 1, 2016). The Division will evaluate the data to determine if further mixing zone analysis is necessary.

Ambient Water Quality

The Division evaluates ambient water quality based on a variety of statistical methods as prescribed in Section 31.8(2)(a)(i) and 31.8(2)(b)(i)(B) of the *Colorado Department of Public Health and Environment Water Quality Control Commission Regulation No. 31*, and as outlined in the Division's Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits (WQP-19). Ambient water quality is evaluated in this WQA analysis for use in determining assimilative capacities and in completing antidegradation reviews for pollutants of concern, where applicable.

To conduct an assessment of the ambient water quality upstream of the Pagosa Springs Sanitation District's WWTF, data were gathered from WQCD Monitoring location 137 (San Juan River above Pagosa Springs) located approximately 7.5 miles upstream from the facility. The most recent data were available for a period of record from February 1990 through May 2008. A summary of the upstream data from this source is presented in Table A-5.

Table A-5
Ambient Water Quality for the San Juan River

Parameter	*Number of Samples*	*15th Percentile*	*50th Percentile*	*85th Percentile*	*Mean*	*Maximum*	*Chronic Stream Standard*	*Notes*
Temp (°C)	36	0.22	7.4	17	7.7	22	-	
DO (mg/l)	52	8.3	11	12	10	14	7	

pH (su)	52	7.4	7.9	8.5	8	9.7	6.5-9	
Fecal Coliform (#/100 ml)	14	2	8	24	10	2300	-	1
E. coli (#/100 ml)	35	1	4	58	6	387	126	1, 2
Total Inorganic Nitrogen (mg/l)	48	0	0	0	0.0092	0.3	-	2
TSS (mg/l)	41	0	0	22	24	0	75	2
TDS (mg/l)	40	61	77	89	75	0	-	3
Al, Dis (µg/l)	38	0	0	145	50	340	-	2
Cd, Dis (µg/l)	55	0	0	0	0.0051	0.28	0.20	2
Cu, Dis (µg/l)	56	0	0	0	0.25	6	3.8	2
Fe, Dis (µg/l)	48	15	32	85	51	360	300	
Fe, TR (µg/l)	48	57	145	1000	705	7400	1000	
Pb, Dis (µg/l)	56	0	0	0	0.45	13	0.84	2
Mn, Dis (µg/l)	56	0	4	6.8	4.9	31	50	2
Se, Dis (µg/l)	40	0	0	0	0	0	4.6	2
Ag, Dis (µg/l)	40	0	0	0	0	0	0.014	2
Sulfate (mg/l)	55	5	9	14	14	300	250	
Hardness as $CaCO_3$ (mg/l)	56	26	38	46	37	90	-	
Note 1: The calculated mean is the geometric mean. Note that for summarization purposes, the value of one was used where there was no detectable amount because the geometric mean cannot be calculated using a value equal to zero.								
Note 2: When sample results were below detection levels, the value of zero was used in accordance with the Division's standard approach for summarization and averaging purposes.								
Note 3: The ambient water quality exceeds the water quality standards for these parameters.								

V. Facility Information and Pollutants Evaluated

Facility Information

The Pagosa Springs Sanitation District's WWTF is located at NE 1/4, SW 1/4, Section 24, T35N, R2W, New Mexico Principal Meridian; south end of Fifth Street, Pagosa Springs, CO 81147; at 37° 15' 11.60" latitude North and 107° 00' 40.03" longitude West in Archuleta County. The current design capacity of the facility is 0.494 MGD (0.76 cfs). Wastewater treatment is accomplished using aerated lagoons. The technical analyses that follow include assessments of the assimilative capacity based on this design capacity.

An assessment of Division records indicate that there are two facilities discharging to the same stream segment or other stream segments immediately upstream or downstream from this facility.

These two facilities are covered by general permits and have limitations set at the water quality standards. These facilities were not modeled in this WQA as they have a minimal impact on the ambient water quality. Other facilities were located more than twenty miles from the Pagosa Springs Sanitation District's WWTF and thus were not considered. The nearest dischargers were:

- San Juan River Village Metro WWTF (COG-588013), which discharges to the San Juan River, is located >7.5 miles upstream of Pagosa Springs Sanitation District's WWTF. Because of the distance from the subject facility, and the 100:1 dilution ratio of the San Juan River versus the

effluent from Village Metro WWTF, this discharger is not expected to impact the assimilative capacities for the pollutants of concern for Pagosa Springs Sanitation District's WWTF.

▪ High Country Lodge WWTF (COG-588002), which discharges to the San Juan River, is located >4 miles upstream of Pagosa Springs Sanitation District's WWTF. Because of the distance from the subject faciltiy, and the 100:1 dilution ratio of the San Juan River versus the effluent from High Country Lodge WWTF, this discharger is not expected to impact the assimilative capacities for the pollutants of concern for Pagosa Springs Sanitation District's WWTF.

Due to the distance between facilities, the ambient water quality background concentrations used in the mass-balance equation (as described in the following section) account for pollutants of concern contributed by upstream sources, and therefore it was not necessary to model upstream dischargers together with the Pagosa Springs Sanitation District's WWTF when determining the available assimilative capacities in the San Juan River.

Pollutants of Concern

Pollutants of concern may be determined by one or more of the following: facility type; effluent characteristics and chemistry; effluent water quality data; receiving water quality; presence of federal effluent limitation guidelines; or other information. Parameters evaluated in this WQA may or may not appear in a permit with limitations or monitoring requirements, subject to other determinations such as a reasonable potential analysis, mixing zone analyses, 303(d) listings, threatened and endangered species listings or other requirement as discussed in a permit fact sheet.

There are no site-specific in-stream water quality standards for BOD_5 or $CBOD_5$, TSS, percent removal, and oil and grease for this receiving stream. Thus, assimilative capacities were not determined for these parameters. The applicable limitations for these pollutants can be found in Regulation No. 62 and will be applied in the permit for the WWTF.

The following parameters were identified by the Division as pollutants to be evaluated for this facility:

- Total Residual Chlorine
- *E. coli*
- Ammonia
- Salinity

Based upon the size of the discharge, the lack of industrial contributors, dilution provided by the receiving stream and the fact that no unusually high metals concentrations are expected to be found in the wastewater effluent, metals are not evaluated further in this water quality assessment.

According to the *Rationale for Classifications, Standards and Designations of the San Juan River*, stream segment COSJSJ06a is designated a water supply because a public water intake point is located ~2.5 miles downstream of Pagosa Springs Sanitation District's WWTF. For this reason, the nitrate standard, which is applied at the point of intake to a water supply, is evaluated. The Division has found, after reviewing the ambient water quality, the WWTF's effluent, and the assimilative

capacity of the San Juan River, that nitrate is not a pollutant of concern and is not evaluated further in this analysis.

During assessment of the facility, nearby facilities, and receiving stream water quality, no additional parameters were identified as pollutants of concern.

VI. Determination of Water Quality Based Effluent Limitations (WQBELs)

Technical Information

Note that the WQBELs developed in the following paragraphs, are calculations of what an effluent limitation may be in a permit. The WQBELs for any given parameter, will be compared to other potential limitations (federal Effluent Limitations Guidelines, State Effluent Limitations, or other applicable limitation) and typically the more stringent limit is incorporated into a permit. If the WQBEL is the more stringent limitation, incorporation into a permit is dependent upon a reasonable potential analysis.

In-stream background data and low flows evaluated in Sections II and III are used to determine the assimilative capacity of the San Juan River near the Pagosa Springs Sanitation District's WWTF for pollutants of concern, and to calculate the WQBELs. For all parameters except ammonia, it is the Division's approach to calculate the WQBELs using the lowest of the monthly low flows (referred to as the annual low flow) as determined in the low flow analysis. For ammonia, it is the standard procedure of the Division to determine monthly WQBELs using the monthly low flows, as the regulations allow the use of seasonal flows.

The Division's standard analysis consists of steady-state, mass-balance calculations for most pollutants and modeling for pollutants such as ammonia. The mass-balance equation is used by the Division to calculate the WQBELs, and accounts for the upstream concentration of a pollutant at the existing quality, critical low flow (minimal dilution), effluent flow and the water quality standard. The mass-balance equation is expressed as:

$$M_2 = \frac{M_3 Q_3 - M_1 Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3)
Q_2 = Average daily effluent flow (design capacity)
Q_3 = Downstream flow ($Q_1 + Q_2$)
M_1 = In-stream background pollutant concentrations at the existing quality
M_2 = Calculated WQBEL
M_3 = Water Quality Standard, or other maximum allowable pollutant concentration

The upstream background pollutant concentrations used in the mass-balance equation will vary based on the regulatory definition of existing ambient water quality. For most pollutants, existing quality is determined to be the 85th percentile. For metals in the total or total recoverable form, existing quality is determined to be the 50th percentile. For pathogens such as fecal coliform and *E. coli*, existing quality is determined to be the geometric mean.

For temperature, the highest 7-day mean (for the chronic standard) of daily average stream temperature, over a seven consecutive day period will be used in calculations of the chronic temperature assimilative capacity, where the daily average temperature should be calculated from a minimum of three measurements spaced equally through the day. The highest 2-hour mean (for the acute standard) of stream temperature will be used in calculations of the acute temperature assimilative capacity. The highest 2-hour mean should be calculated from a minimum of 12 measurements spaced equally through the day.

Calculation of WQBELs

Using the mass-balance equation provided in the beginning of Section VI, the acute and chronic low flows set out in Section IV, ambient water quality as discussed in Section IV, and the in-stream standards shown in Section III, the WQBELs for were calculated. The data used and the resulting WQBELs, M_2, are set forth in Table A-6a for the chronic WQBELs and A-6b for the acute WQBELs.

When the ambient water quality exceeds the in-stream standard, the Division standard procedure is to allocate the water quality standard to prevent further degradation of the receiving waters.

Chlorine: There are no point sources discharging total residual chlorine within one mile of the Pagosa Springs Sanitation District's WWTF. Because chlorine is rapidly oxidized, in-stream levels of residual chlorine are detected only for a short distance below a source. Ambient chlorine was therefore assumed to be zero.

***E. coli*:** There are no point sources discharging *E. coli* within one mile of the Pagosa Springs Sanitation District's WWTF. Thus, WQBELs were evaluated separately. In the absence of *E. coli* ambient water quality data, fecal coliform ambient data are used as a conservative estimate of *E. coli* existing quality. For *E. coli*, the Division establishes the 7-day geometric mean limit as two times the 30-day geometric mean limit and also includes maximum limits of 2,000 colonies per 100 ml (30-day geometric mean) and 4,000 colonies per 100 ml (7-day geometric mean). This 2000 colony limitation also applies to discharges to ditches.

Temperature: The 7E3 low flow is 11 cfs, resulting in a dilution ratio (7E3 low flow to effluent) of 14:1. As the discharge is from a domestic wastewater treatment facility where the available dilution ratio is >10:1, in accordance with the Division's Temperature Policy, no temperature limitations are required.

Table A-6a
Chronic WQBELs

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1	M_3	M_2
E. coli (#/100 ml)	11	0.76	11.76	6	126	***1863***
TRC (mg/l)	11	0.76	11.76	0	0.011	***0.17***

Table A-6b
Acute WQBELs

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1	M_3	M_2

TRC (mg/l)	8.5	0.76	9.26	0	0.019	***0.23***

Ammonia:: The Ammonia Toxicity Model (AMMTOX) is a software program designed to project the downstream effects of ammonia and the ammonia assimilative capacities available to each discharger based on upstream water quality and effluent discharges. To develop data for the AMMTOX model, an in-stream water quality study should be conducted of the upstream receiving water conditions, particularly the pH and corresponding temperature, over a period of at least one year.

The temperature and pH data sets reflecting upstream ambient receiving water conditions were available for the San Juan River based on monitoring from the WQCD site 137. The data, reflecting a period of record from Feburary 1990 through May 2008, were used to establish the setpoint and average headwater conditions in the AMMTOX model. Effluent pH data were also available from the Pagosa Springs Sanitation District's WWTF monitoring data and were used to establish the average facility contributions in the AMMTOX model.

There was not adequate temperature data available for Pagosa Springs Sanitation District's WWTF that could be used as input data for the AMMTOX model. Therefore, the Division standard procedure is to rely on statistically-based, regionalized data for temperature compiled from similar facilities.

The results of the ammonia analyses for the Pagosa Springs Sanitation District's WWTF are presented in Table A-7.

Table A-7
AMMTOX Results for the San Juan River
at the Pagosa Springs Sanitation District's WWTF

Month	*Total Ammonia Chronic (mg/l)*	*Total Ammonia Acute (mg/l)*
January	38	65
February	45	81
March	33	54
April	77	95
May	105	105
June	48	93
July	12	27
August	21	41
September	24	43
October	37	58
November	40	73
December	41	66

Agricultural Use Parameters (SAR):

Section 31.11(1)(a)(iv) of *The Basic Standards and Methodologies for Surface Waters* (Regulation No. 31) includes the narrative standard that State surface waters shall be free of substances that are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life. The interpretation

of these conditions (i.e., "no harm to plants" and "no harm to the beneficial uses") and how they were to be applied in permits were contemplated by the Division as part of an Agricultural Work Group, and culminated in the most recent policy entitled *Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops* (hereafter the Narrative Standards policy).

This discharge is from a domestic WWTF that receives only typical domestic sewage influent and the TDS loading is less than 1 ton/day. Therefore, in accordance with the Division's Narrative Standard Policy WQP-24, no SAR or EC limitations are required.

VII. Antidegradation Evaluation

As set out in *The Basic Standards and Methodologies for Surface Water*, Section 31.8(2)(b), an antidegradation analysis is required except in cases where the receiving water is designated as "Use Protected." Note that "Use Protected" waters are waters "that the Commission has determined do not warrant the special protection provided by the outstanding waters designation or the antidegradation review process" as set out in Section 31.8(2)(b). The antidegradation section of the regulation became effective in December 2000, and therefore antidegradation considerations are applicable to this WQA analysis.

According to the *Classifications and Numeric Standards for San Juan River and Dolores River Basins*, stream segment COSJSJ06a is Undesignated. Thus, an antidegradation review is required for this segment if new or increased impacts are found to occur.

Introduction to the Antidegradation Process

The antidegradation process conducted as part of this water quality assessment is designed to determine if an antidegradation review is necessary and if necessary, to complete the required calculations to determine the limits that can be selected as the antidegradation-based effluent limit (ADBEL), absent further analyses that must be conducted by the facility.

As outlined in the *Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance* (AD Guidance), the first consideration of an antidegradation evaluation is to determine if new or increased impacts are expected to occur. This is determined by a comparison of the newly calculated WQBELs versus the existing permit limitations in place as of September 30, 2000, and is described in more detail in the analysis. Note that the AD Guidance refers to the permit limitations as of September 30, 2000 as the existing limits.

If a new or increased impact is found to occur, then the next step of the antidegradation process is to go through the significance determination tests. These tests include: 1) bioaccumulative toxic pollutant test; 2) temporary impacts test; 3) dilution test (100:1 dilution at low flow) and; 4) a concentration test.

As the determination of new or increased impacts, and the bioaccumulative and concentration significance determination tests require more extensive calculations, the Division will begin the antidegradation evaluation with the dilution and temporary impact significance determination tests. These two significance tests may exempt a facility from further AD review without the additional calculations.

Note that the antidegradation requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the antidegradation review; however, where there is only an acute standard, the acute standard should be used. The appropriate standards are used in the following antidegradation analysis.

Significance Tests for Temporary Impacts and Dilution

The ratio of the chronic (30E3) low flow to the design flow is 14:1, and is less than the 100:1 significance criteria. Therefore this facility is not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

For the determination of a new or increased impact and for the remaining significance determination tests, additional calculations are necessary. Therefore, at this point in the antidegradation evaluation, the Division will go back to the new or increased impacts test. If there is a new or increased impact, the last two significance tests will be evaluated.

New or Increased Impact and Non Impact Limitations (NILs)

To determine if there is a new or increased impact to the receiving water, a comparison of the new WQBEL concentrations and loadings versus the concentrations and loadings as of September 30, 2000, needs to occur. If either the new concentration or loading is greater than the September 2000 concentration or loading, then a new or increased impact is determined. If this is a new facility (commencement of discharge after September 30, 2000) it is automatically considered a new or increased impact.

Note that the AD Guidance document includes a step in the New or Increased Impact Test that calculates the Non-Impact Limit (NIL). The permittee may choose to retain a NIL if certain conditions are met, and therefore the AD evaluation for that parameter would be complete. As the NIL is typically greater than the ADBAC, and is therefore the chosen limit, the Division will typically conclude the AD evaluation after determining the NIL. Where the NILs are very stringent, or upon request of a permittee, the Division will calculate both the NIL and the AD limitation so that the limitations can be compared and the permittee can determine which of the two limits they would prefer, one which does not allow any increased impact (NIL), or the other which allows an insignificant impact (AD limit).

The non impact limit (NIL) is defined as the limit which results in no increased water quality impact (no increase in load or limit over the September 2000 load or limit). The NIL is calculated as the September 2000 loading, divided by the new design flow, and divided by a conversion factor of 8.34. If there is no change in design flow, then the NIL is equal to the September 2000 permit limitation.

If the facility was in place, but did not have a limitation for a particular parameter in the September 2000 permit, the Division may substitute an implicit limitation. Consistent with the First Update to the AD Guidance of April 2002, an implicit limit is determined based on the approach that specifies that the implicit limit is the maximum concentration of the effluent from October 1998 to September 2000, if such data is available. If this data is unavailable, the Division may substitute more recent representative data, if appropriate, on a case by case basis. Note that if there is a change in design flow, the implicit limit/loading is subject to recalculation based on the new design flow. For

parameters that are undisclosed by the permittee, and unknown to the Division to be present, an implicit limitation may not be recognized.

This facility was in place as a discharger prior to September 30, 2000, and therefore the new or increased impacts test must be conducted. As the design flow for this facility is the same as it was in September 2000, the NILs are equal to the permit limitations as of September 2000.
For total ammonia, fecal coliform, and total residual chlorine the limitations as of September 2000 were used in the evaluation of new or increased impacts. In accordance with the Division's practice regarding *E. coli*, an implicit limit for *E. coli* is determined as 0.32 times the permit limit for fecal coliform.

Calculation of Loadings for New or Increased Impact Test

The equations for the loading calculations are given below. Note that the AD requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the AD review; however, where there is only an acute standard, the acute standard should be used. Thus, the chronic low flows will be used later in this AD evaluation for all parameters with a chronic standard, and the acute low flows will be used for those parameters with only an acute standard.

$$\textit{Previous permit load} = M_{permitted}\ (mg/l) \times Q_{permitted}\ (mgd) \times 8.34$$
$$\textit{New WQBELs load} = M_2\ (mg/l) \times Q_2\ (mgd) \times 8.34$$

Where,

$M_{permitted}$ = September 2000 permit limit (or implicit limit) **(mg/l)**
$Q_{permitted}$ = design flow as of September 2000 **(mgd)**
Q_2 = current design flow (same as used in the WQBEL calculations6000
M_2 = new WQBEL concentration **(mg/l)**
8.34 = unit conversion factor

Table A-8 shows the results of these calculations and the determination of a new or increased impact.

Table A-8
Determination of New or Increased Impacts

Pollutant	*Sept 2000 Permit Limit*	*Sept 2000 Permit Load (lbs/day)*	*NIL*	*New WQBEL*	*New WQBEL Load (lbs/day)*	*New or Increased Impact*
E. coli (#/100 ml)*	1920	7910	1920	1863	7675	No
TRC (mg/l)	0.3	1.2	0.3	0.17	0.7	No
NH_3, Tot (mg/l) Jan	25	103	25	38	157	Yes
NH_3, Tot (mg/l) Feb	21	87	21	45	185	Yes
NH_3, Tot (mg/l) Mar	16	66	16	33	136	Yes
NH_3, Tot (mg/l) Apr	22	91	22	77	317	Yes

NH_3, Tot (mg/l) May	48	198	48	118	486	Yes
NH_3, Tot (mg/l) Jun	38	157	38	48	198	Yes
NH_3, Tot (mg/l) Jul	26	107	26	12	49	No
NH_3, Tot (mg/l) Aug	21	87	21	21	87	No
NH_3, Tot (mg/l) Sep	20	82	20	24	99	Yes
NH_3, Tot (mg/l) Oct	20	82	20	37	152	Yes
NH_3, Tot (mg/l) Nov	20	82	20	40	165	Yes
NH_3, Tot (mg/l) Dec	21	87	21	41	169	Yes
*Note that loading for *E. coli* cannot be calculated; but, for comparison purposes, the approach is sufficient; an implicit limit for *E. coli* is determined as 0.32 times the permit limit for fecal coliform. .						

As shown in Table A-8, there are no new or increased impacts to the receiving stream based on the new WQBELS for *E. coli*, total residual chlorine and total ammonia (July and August); for these parameters the AD evaluation is complete and the WQBELs are the final result of this WQA.

For total ammonia (January-May; September-December) there are new or increased impacts and in accordance with regulation, the permittee has the option of choosing either the NIL's or ADBAC's. Because the ADBAC's are generally more stringent than NIL's, the Division assumes that the permittee will choose NIL's rather than ADBAC's, and therefore the Division will stop the AD evaluation at this point and assign the NILs to the permit. For those parameters where there is not a NIL (either implicit or explicit) the AD Guidance allows for the collection of data to determine an implicit limitation. Therefore, the permittee will be required to conduct "monitoring only" for those parameters. The permittee may request ADBAC limits. If the permittee does request ADBAC limits, the Division will proceed with the completion of this Antidegradation Analysis.

VIII. Technology Based Limitations

Federal Effluent Limitation Guidelines

The Federal Effluent Limitation Guidelines for domestic wastewater treatment facilities are the secondary treatment standards. These standards have been adopted into, and are applied out of, Regulation 62, the Regulations for Effluent Limitations.

Regulations for Effluent Limitations

Regulation No. 62, the Regulations for Effluent Limitations, includes effluent limitations that apply to all discharges of wastewater to State waters, with the exception of storm water and agricultural return flows. These regulations are applicable to the discharge from the proposed discharge.

According to Part 62.4(2) of the Regulations for Effluent Limitations "If the Commission has not so promulgated effluent limitation guidelines for any particular industry, but that industry is subject to effluent limitation guidelines promulgated by the United States Environmental Protection Agency pursuant to the Federal Water Pollution Control Act of 1972, the effluent from these industries shall be subject to the applicable EPA guidelines and shall not be subject to the effluent limitations of Regulation 62.4."

Table A-9 contains a summary of the applicable limitations for pollutants of concern at this facility.

Table A-9

Regulation 62 Based Limitations

Parameter	*30-Day Average*	*7-Day Average*	*Instantaneous Maximum*
BOD_5	30 mg/l	45 mg/l	NA
BOD_5 Percent Removal	85%	NA	NA
TSS, mechanical plant	30 mg/l	45 mg/l	NA
TSS, aerated lagoon	75 mg/l	110 mg/l	NA
TSS, non-aerated lagoon	105 mg/l	160 mg/l	NA
TSS Percent Removal	85%	NA	NA
Total Residual Chlorine	NA	NA	0.5 mg/l
pH	NA	NA	6.0-9.0 s.u.
Oil and Grease	NA	NA	10 mg/l

IX. References

Regulations:

The Basic Standards and Methodologies for Surface Water, Regulation 31, Colorado Department Public Health and Environment, Water Quality Control Commission, effective September 30, 2012.

Classifications and Numeric Standards for San Juan River and Dolores River Basins, Regulation No. 34, Colorado Department Public Health and Environment, Water Quality Control Commission, effective March 31, 2013.

Regulations for Effluent Limitations, Regulation 62, CDPHE, WQCC, January 1, 2012.

Policy and Guidance Documents:

Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, December 2001.

Memorandum Re: First Update to (Antidegradation) Guidance Version 1.0, Colorado Department Public Health and Environment, Water Quality Control Division, April 23, 2002.

Rationale for Classifications, Standards and Designations of Segments of the San Juan River, Colorado Department Public Health and Environment, Water Quality Control Division, effective June 2012.

Policy Concerning Escherichia coli versus Fecal Coliform, CDPHE, WQCD, July 20, 2005.

Colorado Mixing Zone Implementation Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, effective April 2002.

Policy for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-23, effective July 3, 2008.

Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-24, effective March 10, 2008.

Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-19, effective May 2002.